



# Indiana Content Standards for Educators

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## MIDDLE SCHOOL MATHEMATICS

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Middle School Mathematics teachers are expected to have a broad and comprehensive understanding of the knowledge and skills needed for this educator license, and to use that knowledge to help students prepare for the challenges and opportunities of the twenty-first century. This requires the ability to identify, comprehend, analyze, synthesize, and evaluate the basic principles, fundamental concepts, and essential content defined in these standards, and to apply that knowledge to the tasks of planning and delivering effective instruction and assessment.

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## Middle School Mathematics Educator Standards

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### Standard 1: Number and Quantity

Middle school mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system.

### Standard 2: Algebra

Middle school mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities, the relationship between dependent and independent variables, and the modeling and solving of problems with algebraic expressions and equations.

### Standard 3: Functions

Middle school mathematics teachers have a broad and comprehensive understanding of the characteristics of functions, the evaluation and comparison of functions, and the use of functions to model relationships between quantities.

### Standard 4: Measurement and Geometry

Middle school mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the characteristics of two- and three-dimensional figures and the relationships between them, and the representation of figures and the proof of theorems using coordinate geometry.

### Standard 5: Statistics and Probability

Middle school mathematics teachers have a broad and comprehensive understanding of the concept of variability and the shape of data distributions, random sampling and drawing inferences about populations, the collection, presentation, and interpretation of data, and the fundamental principles of probability.

### Standard 6: Middle School Mathematics Instruction and Assessment

Middle school mathematics teachers have a broad and comprehensive understanding of content-specific instruction and assessment in mathematics education.

The Indiana Educator Standards for Mathematics describe the knowledge and skills that teachers need to help students achieve the learning outcomes defined by the Indiana Academic Standards for Mathematics. Links to relevant portions of the Indiana Academic Standards can be found below.

[Core Standards](#)  
[Algebra I](#)

[Grade 5](#)  
[Geometry](#)

[Grade 6](#)  
[Algebra II](#)

[Grade 7](#)  
[Pre-Calculus](#)

[Grade 8](#)

### **Standard 1: Number and Quantity**

**Mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system, including the following:**

- 1.1** properties of the real and complex numbers and their subsets
- 1.2** ordering, absolute value, and equivalence of different representations of numbers
- 1.3** number sense and place value, including bases other than base 10
- 1.4** interpreting numerical expressions and applying the order of operations
- 1.5** common factors and multiples
- 1.6** demonstrating computational fluency with rational numbers
- 1.7** applying ratio concepts and proportional reasoning to solve problems
- 1.8** solving problems using different representations of numbers

### **Standard 2: Algebra**

**Mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities, the relationship between dependent and independent variables, and the modeling and solving of problems with algebraic expressions and equations, including the following:**

- 2.1** algebraic notation, language, and expressions
- 2.2** applying arithmetic properties to algebraic expressions and equations
- 2.3** applying the order of operations to algebraic expressions
- 2.4** solving one- and two-variable equations and inequalities
- 2.5** modeling and solving mathematical and real-life problems using numeric and algebraic expressions, equations, and inequalities
- 2.6** connections between proportional relationships, lines, and linear equations
- 2.7** graphical representations of equations and inequalities
- 2.8** solving linear equations and pairs of simultaneous linear equations

### **Standard 3: Functions**

**Mathematics teachers have a broad and comprehensive understanding of the characteristics of functions, the evaluation and comparison of functions, and the use of functions to model relationships between quantities, including the following:**

- 3.1** identifying and extending a variety of patterns and representing them algebraically
- 3.2** characteristics of relations and functions
- 3.3** linear functions, inequalities, systems, and their representations
- 3.4** modeling problems with linear functions, inequalities, systems, and their representations
- 3.5** behaviors of nonlinear functions and relationships between their various representations
- 3.6** modeling problems with quadratic and exponential functions and their representations
- 3.7** manipulation of functions, including transformations, translations, and compositions

### **Standard 4: Measurement and Geometry**

**Mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the properties of two- and three-dimensional figures, and applications of coordinate geometry, including the following:**

- 4.1** converting units within and between the customary and metric measurement systems
- 4.2** points, lines, planes and angle measure in Euclidean geometry
- 4.3** application of length, perimeter, area, and volume formulas of basic geometric figures
- 4.4** indirect measurement, including proportional reasoning, the Pythagorean theorem, and basic trigonometric ratios in right triangles
- 4.5** properties of figures and shapes in two and three dimensions
- 4.6** applying the concepts of similarity and congruence
- 4.7** coordinate and transformational geometry
- 4.8** modeling and solving problems using geometric concepts
- 4.9** reasoning and proof in Euclidean geometry

### **Standard 5: Statistics and Probability**

**Mathematics teachers have a broad and comprehensive understanding of the collection and presentation of data, the summary and descriptions of statistical variability, and the fundamental principles of probability, including the following:**

- 5.1** summarizing, representing, and interpreting data for one or two variables
- 5.2** making inferences and evaluating claims based on data
- 5.3** sampling, bias, and randomization
- 5.4** simple, compound and conditional probabilities
- 5.5** representations of probabilities
- 5.6** modeling and solving problems with normal, uniform, and binomial probability distributions

### **Standard 6: Middle School Mathematics Instruction and Assessment**

**Mathematics teachers have a broad and comprehensive understanding of content-specific curriculum, instruction, and assessment in mathematics education, including the following:**

- 6.1** the Indiana Academic Standards and Core Standards for Mathematics
- 6.2** the Common Core State Standards for Mathematics, the NCATE/NCTM Standards for Mathematics, and the ISTE National Educational Technology Standards
- 6.3** instructional strategies and resources for promoting student understanding of concepts and skills related to mathematics, including the use of multiple representations
- 6.4** evaluation and development of curriculum and curricular materials (including textbooks and digital content) that support standards-based instruction and assessment
- 6.5** strategies and skills for planning and differentiating mathematics instruction, based on the Indiana Response to Instruction (RtI) model, to meet the needs of all learners
- 6.6** instructional strategies to promote student learning and to connect the *Standards for Mathematical Content* to the *Standards for Mathematical Practice* of the Common Core State Standards
- 6.7** communication methods that promote student learning and foster active inquiry, interaction, and collaboration in the mathematics classroom
- 6.8** strategies and skills for selecting, adapting, and using technology to enhance the teaching and learning of mathematics
- 6.9** strategies and skills for effectively assessing student understanding and mastery of essential mathematics concepts and skills
- 6.10** implementation of the Indiana Response to Instruction (RtI) model for all students, including differentiation in Tiers 1 and 2 and intensive intervention and extension in Tier 3

## Selected Bibliography of Standards and Sources Related to Middle School Mathematics

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### State and National Standards and Curriculum Frameworks

1. Indiana Department of Education. (2010). *Indiana academic standards for mathematics*.
2. Indiana Department of Education. (2008). *Indiana's core standards for mathematics: core academic concepts across the K–12 continuum. A companion to Indiana's academic standards*. <http://dc.doe.in.gov/Standards/AcademicStandards/PrintLibrary/docs-core/2008-06-09-corestandards-math.pdf>
3. Council of Chief State School Officers (CCSSO)/National Governors Association (NGA). (2010). *Common core state standards for mathematics*. <http://www.corestandards.org/the-standards/mathematics>
4. National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*.
5. National Council for Accreditation of Teacher Education (NCATE)/National Council of Teachers of Mathematics (NCTM). (2003). *Standards for middle level mathematics teachers*. [http://www.nctm.org/uploadedFiles/Math\\_Standards/NCTMMIDDLEStandards%281%29.pdf](http://www.nctm.org/uploadedFiles/Math_Standards/NCTMMIDDLEStandards%281%29.pdf)
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7. International Society for Technology in Education (ISTE). (2008). *The ISTE NETS and performance indicators for teachers (NETS-T)*. [http://www.iste.org/Libraries/PDFs/NETS\\_for\\_Teachers\\_2008\\_EN.sflb.ashx](http://www.iste.org/Libraries/PDFs/NETS_for_Teachers_2008_EN.sflb.ashx)

### Sources on Mathematics Content

8. Cuoco, A., Goldenberg, E. P., & Mark, J. (2010). Organizing a curriculum around mathematical habits of mind. *Mathematics Teacher*, 103(9), 682–688.
9. Jankvist, U. T. (2009). A categorization of the "whys" and "hows" of using history in mathematics education. *Educational Studies in Mathematics*, 71(3), 235–261.
10. Steen, L. A. (2006). Facing facts: Achieving balance in high school mathematics. *Mathematics Teacher*, 100, 86.
11. Schmidt, W., Houang, R., & Cogan, L. (2004). A coherent curriculum: The case of mathematics. *Journal of Direct Instruction*, 4(1), 13–28.

### Sources on Student Learning and Pedagogical Methodology

12. Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States*. New York: Routledge.
13. Silverman, J., & Clay, E. L. (2010). Online asynchronous collaboration in mathematics teacher education and the development of mathematical knowledge for teaching. *Teacher Educator*, 45(1), 54–73.
14. Reed, H. C., Drijvers, P., & Kirschner, P. A. (2010). Effects of attitudes and behaviours on learning mathematics with computer tools. *Computers & Education*, 55(1), 1–15.
15. Morris, A. K., Hiebert, J., & Spitzer, S. M. (2009). Mathematical knowledge for teaching in planning and evaluating instruction: What can preservice teachers learn? *Journal for Research in Mathematics Education*, 40(5), 491–529.
16. Simon, M. A. (2009). Amidst multiple theories of learning in mathematics education. *Journal for Research in Mathematics Education*, 40(5), 477–490.
17. Hoffman, B. L., Breyfogle, L. M., & Dressler, J. A. (2009). The power of incorrect answers. *Mathematics Teaching in the Middle School*, 15(4), 232–238.

## Alignment of Educator Standards with State and National Standards

Indiana Educator Standards for Mathematics	Indiana Academic Standards for Mathematics (5-9)	Indiana Core Standards for Mathematics (5-9)	Common Core State Standards for Mathematics (5-9)	NCATE/NCTM Standards for Middle Level Mathematics	ISTE National Educational Technology Standards
<b><u>Standard 1: Number and Quantity</u></b> Middle school mathematics teachers have a broad and comprehensive understanding of number operations and algebraic thinking, ratios and proportional relationships, and the number system.	5.1, 5.2, 5.7, 6.1, 6.2, 6.7, 7.1, 7.2, 7.7, 8.1, 8.2, 8.7, A1.1	CS5-1, CS6-1, CS7-1, CS8-1,	5.OA, 5.NBT, 5.NF, 6.RP, 6.NS, 7.RP, 7.NS, 8.NS, N-RN, N-CN	1, 5, 9, 10	
<b><u>Standard 2: Algebra</u></b> Middle school mathematics teachers have a broad and comprehensive understanding of the extension of arithmetic to one- and two-variable expressions, equations, and inequalities, the relationship between independent and dependent variables, and the modeling and solving of problems with algebraic expressions and equations.	5.3, 5.7, 6.3, 6.7, 7.3, 7.7, 8.3, 8.7, A1.1, A1.2, A1.4, A1.5, A1.6, A1.9	CS5-3, CS6-3, CS7-3, CS8-3, A1-1, A1-4, A1-5, A1.6	6.EE, 7.EE, 8.EE, 8.F, N-Q, A-SSE, A-APR, A-CED, A-REI	1, 2, 3, 5, 9, 10	



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<b><u>Standard 3: Functions</u></b> Middle school mathematics teachers have a broad and comprehensive understanding of the characteristics of functions, the evaluation and comparison of functions, and the use of functions to model relationships between quantities.	5.3, 5.7, 6.7, 7.3, 7.7, 8.3, 8.7, A1.2, A1.3, A1.4, A1.5, A1.7, A1.8, A1.9, A2.8, A2.9, A2.10	CS5-3, CS6-3, CS7-3, CS8-3, A1.2, A1.3, A1.4, A1-5, A1-7	6.EE, 7.EE, 8.EE, F-IF, F-BF, F-LE, G-SRT	1, 3-5, 10	
<b><u>Standard 4: Measurement and Geometry</u></b> Middle school mathematics teachers have a broad and comprehensive understanding of the principles and procedures of measurement, the characteristics of two- and three-dimensional figures and the relationships between them, and the representation of figures and the proof of theorems using coordinate geometry.	5.3, 5.4, 5.5, 5.7, 6.4, 6.5, 6.7, 7.4, 7.5, 7.7, 8.4, 8.5, 8.7, A1.1, G.1-8	CS5-2, CS6-2, CS7-2, CS8-2, CSG-1-9	5.MD, 5.G, 6.G, 7.G, 8.G, G-CO, G-SRT, G-C, G-GPE, G-GMD, G-MG, N-Q	1-5, 11, 15	

## Alignment of Educator Standards with State and National Standards

Indiana Educator Standards for Mathematics	Indiana Academic Standards for Mathematics (5-9)	Indiana Core Standards for Mathematics (5-9)	Common Core State Standards for Mathematics (5-9)	NCATE/NCTM Standards for Middle Level Mathematics	ISTE National Educational Technology Standards
<b><u>Standard 5: Statistics and Probability</u></b> Middle school mathematics teachers have a broad and comprehensive understanding of the concept of variability and the shape of data distributions, random sampling and drawing inferences about populations, the collection, presentation, and interpretation of data, and the fundamental principles of probability.	5.6, 5.7, 6.6, 6.7, 7.6, 7.7, 8.6, 8.7, A2.9, PS.1, PS.2	CS7-4, CS8-4, AII-10	6.SP, 7.SP, 8.SP, S-ID, S-IC, S-CP, S-MD	1–5, 14	
<b><u>Standard 6: Mathematics Instruction and Assessment</u></b> Middle school mathematics teachers have a broad and comprehensive understanding of content-specific instruction and assessment in mathematics education.				7, 8, 16	1a, 1b, 1c, 1d 2a, 2b, 2c, 2d 3a, 3b, 3c, 3d 4a, 4b, 4c, 4d 5a, 5b, 5c, 5d